absorbing metal-containing filler in the form of dispersed particles, where said filler material is a poly-dispersed mixture containing metallic particles having a size between 10^{-9} and 10^{-3} m, wherein said particles are bonded to an intermediate substrate surrounded by the volume of the matrix formed of a composition derived from at least one compound that solidifies under pressure.

A3

REMARKS

This Amendment is based on the Office Action dated March 14, 2002. The Examiner's comments in that Action have been carefully considered.

A Petition for Reinstatement (fee: $650.00) is being submitted along with this Amendment. An Information Disclosure Statement and Information Disclosure Citation are also being submitted with this Amendment (fee: $180.00). The total in fees of $830.00 is being submitted as a check attached to this application. If these fees are insufficient, please charge any remainder due to account no. 10-0100.

Clarifications to the Subject Application

In paragraph 2 of the Examiner's Office Action, the subject application is criticized as containing terminology that would not necessarily be accessible to one skilled in the art. Applicants regard their terminology as accessible, and consider that, with the amendments to the language and grammar of the original patent application, this applicant should now be clear as to its techniques, goals and effects. In order to further clarify the present invention, applicants discuss several of its most important features below.

In response to the Examiner's arguments on paragraphs 4-6 of the Office Action, it is important to note that the X-ray absorbing material disclosed in the subject application has X-ray absorbing properties equal to those of the more conventionally used materials. However, the material of the subject application contain considerably less X-ray absorbing filler material, and, in particular, a substantially fewer number of metal particles. This goal is achieved by the subject application's use of metal-containing particles *in a poly-dispersed mixture*, where said particles form *energetically interconnected X-ray absorbing groups*. The creation of these groups ensures higher radiation absorption when compared with the materials based on monolithic elements.

The decrease in density exhibited by the claimed material is caused by the fact that the present invention, by ensuring the certain dispersability of the filler particles and their distribution throughout the matrix (for example, as in a textile base), also ensures that these filler particles will provide the same level of X-ray absorption as a material made up entirely of the filler particles. The filler particles of the present invention, disposed as they are into energetically interconnect groups, ensure these heightened absorbing properties. This disposition of the particles is achieve through a prior mixing (a segregation) of these particles (for example, in a mixer) to the point that they organize themselves into a system of X-ray absorbing groups.

Applicants respectfully point out that the invention according to claim 1 does not indicate the use of a polymer.

In the specification, the phrase "the density of the X-ray absorbing material, at X-ray absorbing properties of the material being equal to those of the material used for the particles of the X-ray absorbing filler, is defined by the relation: $\rho m = (0.01 - 0.20)\rho p$" means that the claimed X-ray absorbing material, having the density ρm, is characterized by the same capacity to absorb Roentgen radiation as another filler material ρp even though the density of the claimed X-ray absorbing material is less than the density of the other filler material. The coefficient of decrease in the claimed density of each material is defined as being within the range of 0.01 to 0.20. (Alternative versions of this equation in the specification and the claims are due to the use of variant mathematical signs to denote "from ... to": the European manner is "–" and the Russian manner is "÷". The meaning of these two signs is, however, the same in this context.)

Applicants confirm the Examiner's understanding that the phrase "a textile base serves as a matrix; and wherein the particles are bonded to the surface of said textile base" should be construed as "particles to be bonded to the surface of the textile base as well as embedded in said textile base so that said textile base functions as a matrix."

In paragraph 7 the Examiner indicates that in claims 2 and 3 of the present invention a polymer, functioning as one of the components of the X-ray absorbing material, is a carrying matrix, i.e., the polymer embraces, fixes and retains the filler particles. The particles of the filler, being another component of the claimed material, are thus grasped by the volume of the matrix. Thus, the Examiner is correct in concluding that the filler

particles are "suspended" in a polymer.

The positioning of the filler particles, along with the formation of energetically interconnected groups that ensure heightened X-ray absorbing properties, is achieved by means of the prior mixing (segregation) of the particles (for example, in a mixer) until the particles organize themselves into systems of X-ray absorbing groups that ensure the increase in the filler's capacity for photo-absorption. (Note, however, that this does not imply the uniform distribution of the particles.) This specific use of a poly-dispersed mixture as a filler makes possible the predetermined goal of the present invention.

The equation "M = (0.05 ÷ 0.5)m" (or "M = (0.05 – 0.5)m" in the European style), as set forth in claim 2, means that the X-ray absorbing material of the invention has the same capacity to absorb Roentgen radiation as the material of the filler. However, the mass of the claimed material is significantly lower than the mass of an equivalent amount of the other filler material. The coefficient of the filler material mass decrease is defined within the range of 0.05 to 0.50.

In citing the above equation the applicants confirm that a poly-dispersed mixture of particles, used as a filler for the claimed material, is characterized by heightened X-ray absorption than those of a filler based on monolithic elements. This is caused by the particles, in being mixed in a poly-dispersed mixture, create energetically interconnected X-ray groups that have the capacity for an anomalous and abnormally high weakening of Roentgen radiation. It is just this capacity that was integrated into the present invention.

The material of the present invention – a poly-dispersed mixture formed of filler particles that has mass M – and another, but monolithic material – having mass m – display identical levels of X-ray absorption but significantly different masses. The mass of the claimed material is expressed in the above equation.

An object of the present invention is to provide an X-ray absorbing material. This material contains one component (here, a filler in the form of a poly-dispersed material) that intensively absorbs Roentgen radiation, and another component that fixes and retains said filler as part of the composition of the X-ray absorbing material (here, a matrix). The matrix – a polymeric material, as a rule – does not have its own (substantial) X-ray absorbing properties. For this reason applicants do not draw the Examiner's attention to any specific properties of the matrix material. (The matrix can be made of only one component , for example, caoutchouc or a composition made on the basis of caoutchouc – for example, a film-forming compound or a rubber-like mixture.) The basic purpose of the matrix is to retain and fix the poly-dispersed filler. This fact would be apparent to those skilled in the art and so is not stated within applicants' claims.

We reiterate that the specific matrix material for carrying the X-ray absorbing particle filler can be made of <u>any</u> possible material or composition based on such a material. The specific composition of the matrix is <u>not</u> determinative in the creation of the X-ray absorbing material. The focus of the present invention is to provide a filler that, in its form as a poly-dispersed mixture that has been segregated by mixing, reveals a capacity

for an abnormally high weakening of Roentgen radiation. The use of just this filler as it is introduced into the matrix allows for the creation of an X-ray absorbing material with new and substantially more useful qualities.

The Examiner has questioned the necessity of using, for the particles, exactly those parameters of size set forth in the present invention. He has also queried how the metals used are to be selected.

In the present invention, it is necessary to emphasize the importance of the definite parameters of the metal particles claimed and their influence on the effect they are able to achieve. These particle parameters are crucial to the achievement of the invention's product. As described in the materials filed, and as noted by applicants in our previous Responses to the Examiner's inquiry, the synergistic effect discussed has been shown in the course of experimental studies and empirical assays. This synergistic effect has been registered and recorded by the Russian Academy of Natural Sciences as Diploma No. 57 dd. September 19, 1996, "The Phenomenon of Abnormal Change of Intensity in the Quanta Flow of Penetrating Radiation Using Media Composed of Mono- and Multi-Elements").

The upper limit in the parameters given for the particles has been determined experimentally. Empirical study has confirmed that when metal-bearing particles that are larger than 10^{-3} m are used, groups of particles bound at the energy level do not form, i.e., a new and sudden effect is not found.

Experiments using particles even smaller than the minimal size specified in the subject application (less than 10^{-9} m) have also been conducted. However, the fact that the use of smaller particles, on the one hand, considerably complicates the technological process and, on the other hand, essentially raises production costs, the inventors are of the opinion that the use of particles smaller than 10^{-9} m is inexpedient.

The limits claimed for the sizes of the particles – namely, from 10^{-9} to 10^{-3} m – that make up the poly-dispersed mixture are optimum for attaining the effect that is the goal of the present invention. This is stated in the last sentence on page 2 of the specification: "Meanwhile, it is generally known that the use of poly-dispersed mixtures consisting of particles having a size between 10^{-9} up to 10^{-3} m in modern engineering does not require any specific limitations and is not fraught with any specific technological difficulties in manufacture, transportation, storage and use."

Considering the fact that, at the moment, no scientific substantiation exists for the causes of the interaction between X-ray radiation and the groups of metal-bearing particles of a specified size bound together at an energy level and incorporated in the poly-dispersed mixture, applicants respectfully request that the Examiner accepts the inventors' declaration that all parameters claimed in this application are, in fact, necessary and sufficient in the achievement of the desired effect.

With regard to the specification of particular metals, the following metals may be used: iron, copper, aluminum, tin, gold, silver, tungsten, bismuth, cadmium, lanthanides

from to dysprosium, other metals, the chemical compounds hereof, their oxides, salts, metal alloys and/or mixtures. For each particular technical process according to the invention, a particular metal is chosen from a consideration of the optimal relation between the absorbing ability, mass, price and the greatest possible harmlessness to a human being. Sometimes, as described in the examples given regarding the invention, it is advantageous to use tungsten; in other cases, the lanthanides are the optimal choice. Thus the particular metals used are not always critical, and the claims are not intended to be limited to any particular metal.

Prior art: References to U.S. Patent No. 5,849,311 (Sawan et al.) and GB 1260342.

1. U.S. Patent No. 5,849,311 (Sawan et al.)

The significant features of the invention are comprised of at least one of the following sets of characteristics:

A. Embodiment 1 has:

- a matrix with a fixed X-ray absorbing metal-containing filler;
- as a metal-containing filler a segregated by mixing poly-dispersed mixture in the form of dispersed particles;
- particles of filler of the size: 10^{-9} and 10^{-3};
- a matrix in the form of a textile base;
- filler particles fixed on the surface of the matrix; and
- the density of the claimed X-ray absorbing material, while ensuring X-ray absorbing properties equal to those of an article made of the same material as the material of the filler particles that are fixed on the matrix surface is equal to (from 0.01 to 0.2) from the density of an article made of the material of the filler particles.

B. Embodiment 2 has:

- a matrix made of at least one component solidifying at atmospheric pressure or a composition based on such a component;
- particles of the filler grasped by the volume of the matrix; and
- the mass of filler material particles of the claimed material, while ensuring the X-ray absorbing properties being equal to those of the article manufactured from the same material as the material of the particles, is equal (from 0.05 to 0.5) from the mass of the article made of the same material as the particles.

C. Embodiment 3 has:

- a matrix made of at least one component, or composition based on such component, said component or composition solidifying at atmospheric pressure; and
- the particles of filler fixed on an intermediate carrier embraced by the volume of the matrix.

U.S. Patent No. 5,859,311 to Sawan et al. relates to antimicrobial materials. It is well known that practically all materials are characterized by X-ray protective properties to a certain degree. In passing through a substance, X-rays are weakened to a greater or lesser degree. The greater the section of interaction between the substances and the X-rays, the greater the amount of X-ray protection afforded by the substance. Therefore, heavy metals, which have a great section of interaction – in particular, lead (which is a toxic material) – are primarily used as X-ray protection materials.

The main object of the present invention is to decrease the mass and thickness of an X-ray absorbing material while at the same time retaining its protective characteristics and excluding the possibility of the material being or becoming toxic.

The incorporation of metallic particles into an organic polycationic polymer matrix with the formation of an emulsion and with the further impregnation of woven or non-woven

materials with such an emulsion are described in the Sawan reference. This process does not offer a solution to the task described above. Sawan does not teach the formation of groups of particles in its metal-containing emulsion, a group formation that would lead to an increased in X-ray protection properties. The availability of such particles in the matrix does not create, in the Sawan reference, a synergistic effect that would ensure greater X-ray protection properties with a material having minimal density and mass.

Furthermore, the Sawan patent does not contain a large number of features of the present invention, including –

- a metal-containing filler segregated by mixing a poly-dispersed mixture in the form of poly-dispersed particles;
- filler particles sized between 10-9 and 10-3 m;
- the feature that the density of the claimed X-ray absorbing material, at the same time that it ensures X-ray absorbing properties equal to those of an article made of the same material as the material of the particles fixed on the matrix surface, is equal to (from 0.01 to 0.2) of the density of an article made from the material of these particles;
- the feature that the mass of the filler particles of the claimed material, at the same time that it ensures that its X-ray absorbing properties are equal to those of the article manufactured from the same material as the material of the particles, is equal to (from 0.05 to 0.5) of the mass of the article made of the same material of the particles; and
- the particles of the filler are fixed on an intermediate carrier embraced by the volume of the matrix.

These features in particular, and in combination with the other features described above, are neither taught nor suggested in the Sawan patent.

2. GB 1260342.

This British patent has already been considered by the application in searching the

prior art and was cited in the application materials as a prior art prototype. However, as the subject specification make clear, the drawback of the invention disclosed in this patent is the irregularity of filler distribution within the volume of the matrix, which cause the X-ray protective properties of the material to be uneven.

In the disclosure of the subject application, the increase in X-ray absorption is based on the empirically confirmed capacity of poly-dispersed mixtures comprised of particles having a size of between 10^{-9} and 10^{-3} m to organize themselves into energetically interconnected X-ray absorbing groups, which results in an abnormally high capacity to weaken Roentgen radiation. This synergistic effect occurs during the segregation stage as the particles intermix. The groups, thus organized, acquire high X-ray protective properties that are consistent through the volume of the matrix. That is, in the subject application, the basic groups do not only provided high X-ray protection where the filler particles are concentrated.

In the British patent, the X-ray absorption capacity of the material is equal to the sum effect of the X-ray absorbing effects of the metals included therein – i.e., the metals incorporated into the material functions as a result of its intrinsic features. In the subject application, by contrast, to obtain the same level of X-ray absorption in the material as is exhibited by the filler material, one must merely introduce 2 to 20 times less material than if the material had been entirely composed of filler material.

The applicant agrees with the Examiner that the use of fibrous materials to

strengthen the mechanisms of plastics and polymers is known. However, in creating the method of the present invention and its X-ray absorbing material, applicant did not intend to improve on the mechanical characteristics of polymer qualities, but rather used a fibrous material (including mineral fiber) as an intermediate carrier on which the X-ray absorbing filler was fixed in a poly-dispersed mixture that had by segregated by mixing, a mixutre composed of metallic particles. In other words, in the subject application a mineral fiber having particles of a poly-dispersed mixture fixed on such fiber becomes a spectacular filler in its X-ray absorbing properties. The fact that it is introduced into a polymeric matrix is in no way apparent from the cited British reference nor from anything else in the prior art.

In view of the arguments above, and in view of the amendments made herein to the specification and claims, applicants believe that this application is in condition for allowance. Early allowance and issuance are respectfully solicited.

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Respectfully submitted,

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